ISSN 1996-3343

Asian Journal of Applied Sciences

Knowledgia SCIENTIFIC
A Place to Publish Outstanding Research
http://knowledgiascientific.com

Measuring the Temperature of Nanoparticles

One of the holy grails of nanotechnology in medicine is to control individual structures and processes inside a cell. Nanoparticles are well suited for this purpose because of their small size; they can also be engineered for specific intracellular tasks. When nanoparticles are excited by radio-frequency (RF) electromagnetic fields, interesting effects may occur. For example, the cell nucleus could get damaged inducing cell death; DNA might melt; or protein aggregates might get dispersed.

Some of these effects may be due to the localized heating produced by each tiny nanoparticle. Yet, such local heating, which could mean a difference of a few degrees Celsius across a few molecules, cannot be explained easily by heat-transfer theories. However, the existence of local heating cannot be dismissed either, because it's difficult to measure the temperature near these tiny heat sources.

Scientists at Rensselaer Polytechnic Institute have developed a new technique for probing the temperature rise in the vicinity of RF-actuated nanoparticles using fluorescent quantum dots as temperature sensors. The results are published in the Journal of Applied Physics.

Amit Gupta and colleagues found that when the nanoparticles were excited by an RF field the measured temperature rise was the same regardless of whether the sensors were simply mixed with the nanoparticles or covalently bonded to them. "This proximity measurement is important because it shows us the limitations of RF heating, at least for the frequencies investigated in this study," says project leader Diana Borca-Tasciuc. "The ability to measure the local temperature advances our understanding of these nanoparticle-mediated processes."